YAKEEN NEET 2.0

2026

Basic Maths and Calculus (Mathematical Tools)

Physics | **Assignment Solution 04**

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Question-01

$e^0 = 1$

$e^\alpha = \alpha$

$e^{-\alpha} = \frac{1}{e^\alpha} = \frac{1}{\alpha} = 0$

$\sqrt{9} = 3$

$\sqrt{4} = 2$

$\sqrt{16} = 4$

Find value of given mathematical expression.

(i) $e^{-\infty} = 0$

(ii) $\cos 3^\circ = 1$

$\boxed{\sin\theta = \theta = \tan\theta}$

(iii) $\frac{1}{(0.001)} = \frac{1}{\frac{1}{1000}} = 1000$

(iv) $\frac{6}{0.3} = \frac{\cancel{6}^{2}}{\cancel{3}/10} = 20$

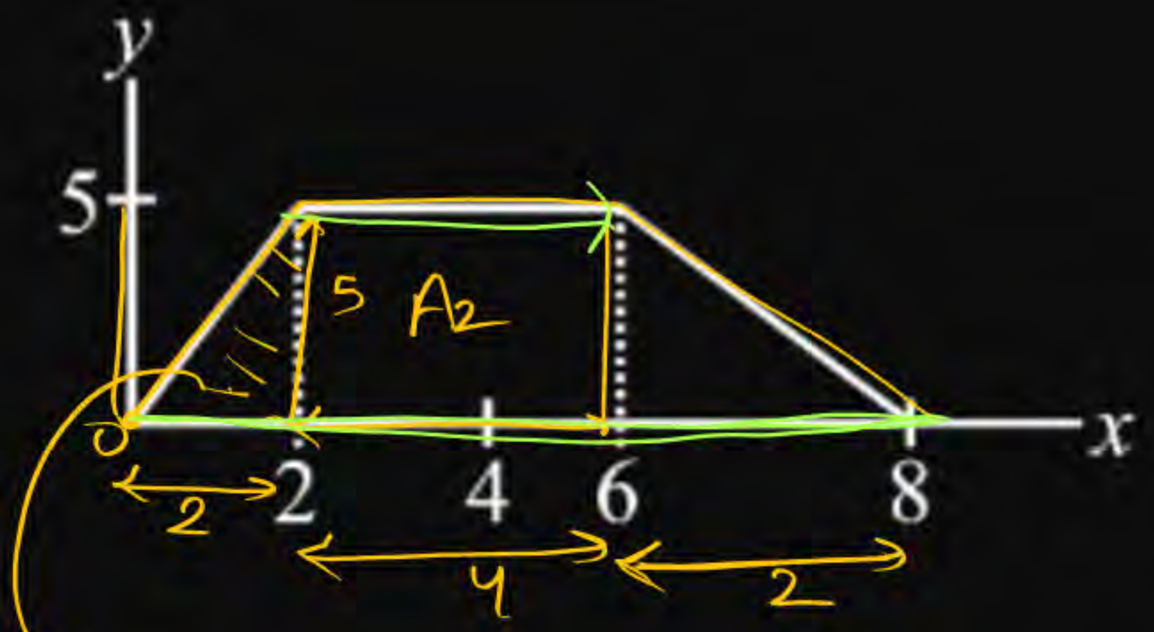
(v) $\sqrt{0.49} = \sqrt{\frac{49}{100}} = \frac{7}{10} = 0.7$

(vi) $e^0 = 1$

(vii) $\sqrt{1 - 0.19} = \sqrt{1.00 - 0.19} = \sqrt{0.81} = 0.9$

Question-02

Find area of given graph



$$\text{Area} = \frac{1}{2} \times (8+4) \times 5$$

$$= \frac{1}{\cancel{2}} \times \cancel{12}^{6} \times 5 = 30$$

$$A_1 = \frac{1}{\cancel{2}} \times \cancel{2} \times 5 = 5$$

$$A_2 = 5 \times 4 = 20$$

$$A_3 = \frac{1}{\cancel{2}} \times \cancel{2} \times 5 = 5$$

$$\text{Area} = 30$$

Question-03

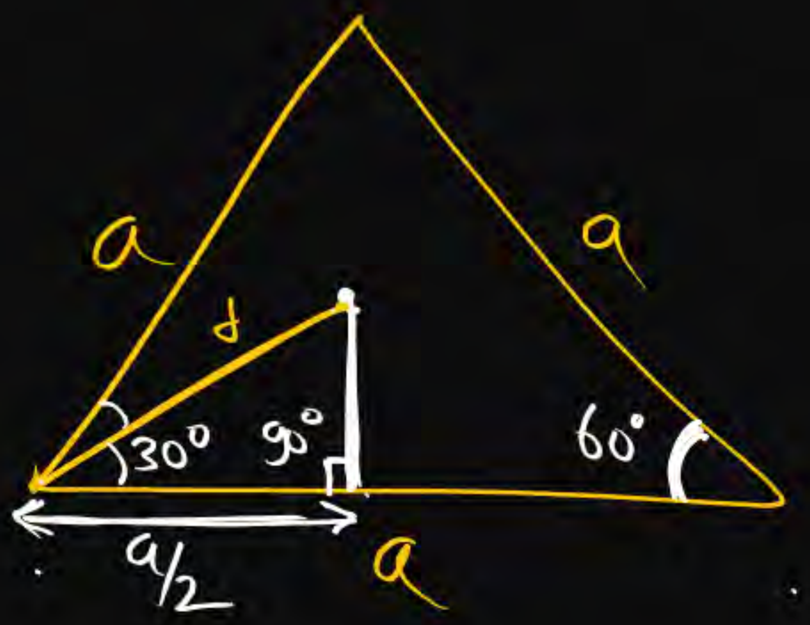
Which of the following formula is wrong.

1. $\sin 2\theta = 2\sin\theta . \cos\theta$ ✓
2. $\cos(2\theta) = \cos^2\theta - \sin^2\theta$ ✓
3. $\sin\theta = 2\sin\frac{\theta}{2}\cos\frac{\theta}{2}$ ✓
4. $\cos\theta = \sin^2\frac{\theta}{2} - \cos^2\frac{\theta}{2}$

$\sin\theta = 2\sin\theta/2 \cdot \cos\theta/2$

$\boxed{\cos 2\theta = \cos^2\theta - \sin^2\theta}$

Find distance between centre to corner of equilateral triangle of side a.



$$\cos 30^\circ = \frac{a/2}{d}$$

$$\frac{\sqrt{3}}{\cancel{2}} = \frac{a}{\cancel{2}d}$$

$$\boxed{d = \frac{a}{\sqrt{3}}}$$

Question-05

Find value of different trigonometric ratio

(i) $\sin(-45°) = -\frac{1}{\sqrt{2}}$

(ii) $\cos(405°) = \cos(360 + 45°) = \frac{1}{\sqrt{2}}$

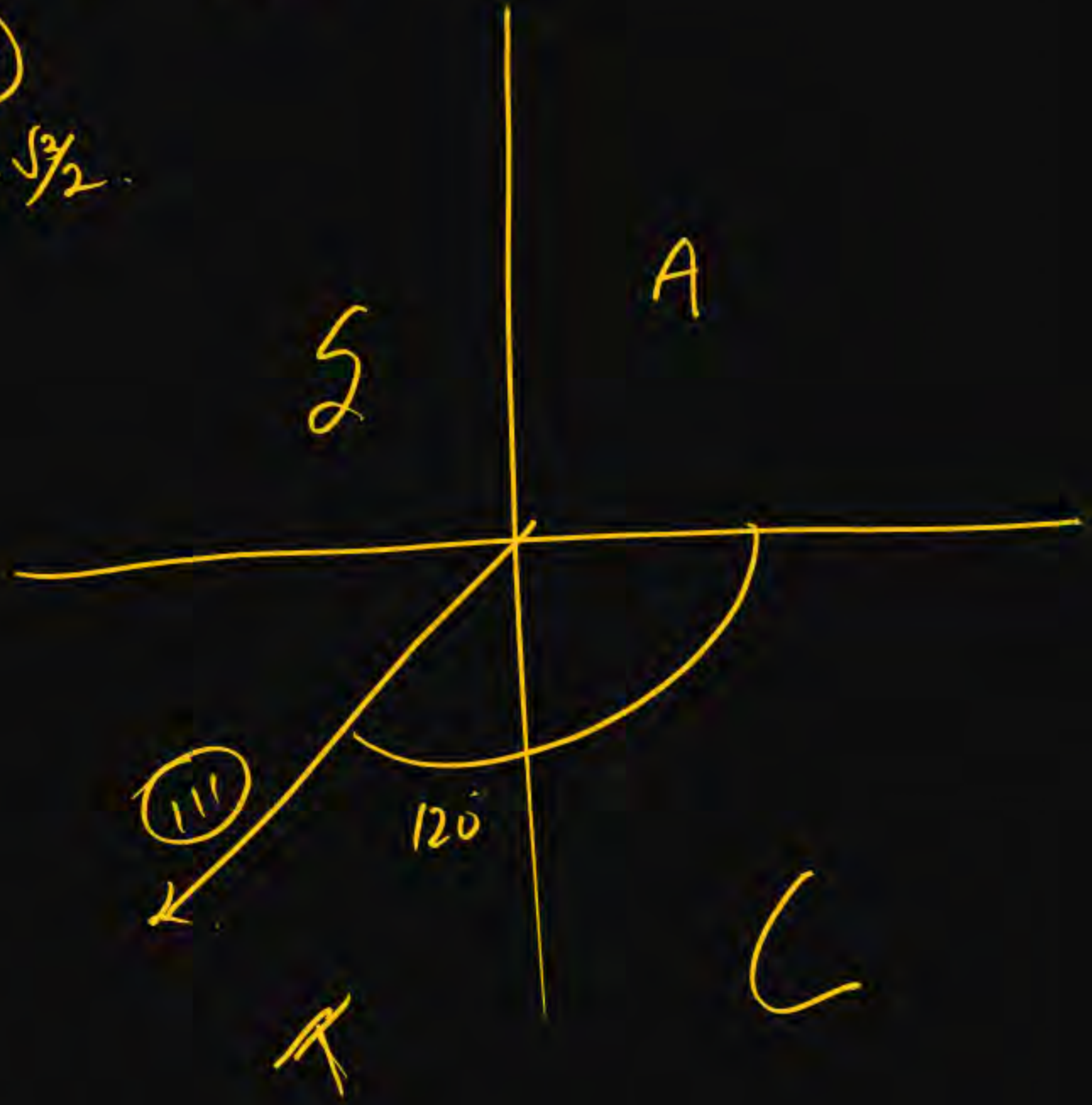
(iii) $\sin(390°) = \frac{1}{2}$

(iv) $\sin(300) = \sin(360° - 60°)$
$= -\sin 60° = -\frac{\sqrt{3}}{2}$

(v) $\tan(-120°) = -\underbrace{\tan 120°}$
$= -(-\sqrt{3}) = +\sqrt{3}$

$\sin(390°) = \sin(360° + 30) = \sin 30 = \frac{1}{2}$

$$\boxed{\tan(-\theta) = -\tan\theta}$$



$$\sin(750) = \sin(720^\circ + 30) = \sin 30^\circ = \frac{1}{2}$$

Question-06

If sin (α) = 0.6 and cos (β) = 0.8, where α and β are acute angles, what is the value of sin (α + β)?

1. 0.28
2. 0.48
3. 0.96
4. 1.88

$\cos\alpha = \sqrt{1-\sin^2\alpha} = \sqrt{0.64} = 0.8$

$= \sqrt{1-0.36}$

$\sin(\alpha) = 0.6$

$\cos\beta = 0.8$

$\sin\beta = 0.6$

$\sin(\alpha+\beta) = \sin\alpha \cdot \cos\beta + \cos\alpha \cdot \sin\beta$

$= 0.6 \times 0.8 + 0.8 \cdot 0.6$

$= \frac{48}{100} + \frac{48}{100}$

$= \frac{2 \times 48}{100} = \frac{96}{100}$

$= 0.96$

Question-07

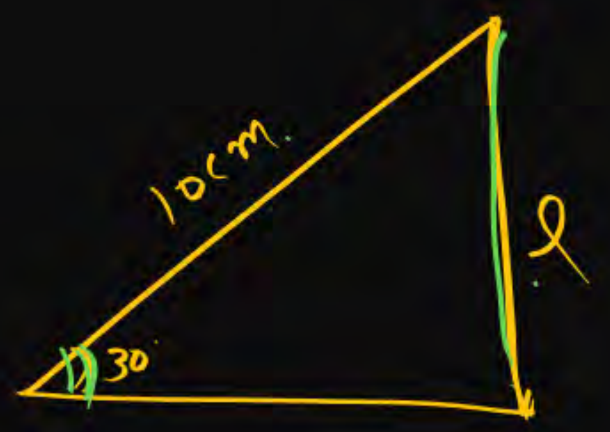
In a right triangle, the length of the hypotenuse is 10 cm and one of the acute angles is 30°. What is the length of the side opposite to the 30° angle?

(1) 5 cm

(2) $5\sqrt{3}$ cm

(3) 10 cm

(4) $10\sqrt{3}$ cm



$$\sin 30^\circ = \frac{l}{10}$$

$$l = 10 \times \frac{1}{2}$$

Question-08

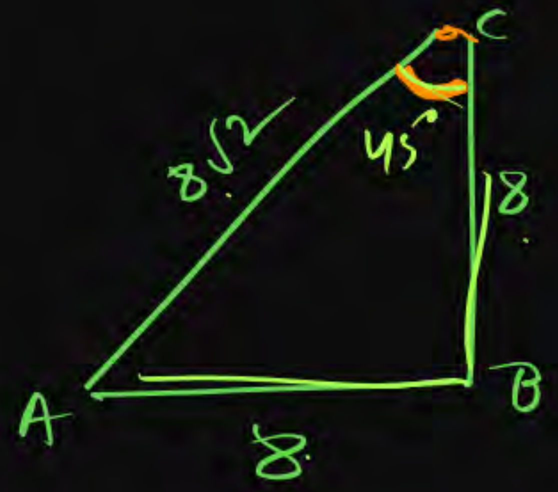
If a triangle ABC, the side AB is 8 cm, side BC is 8 cm, and side AC is $8\sqrt{2}$ cm. What is the measure of angle C?

(1) 30°

(2) 45°

(3) 60°

(4) 90°



Question-09

If $\cos(\alpha) = \frac{1}{\sqrt{2}}$ and $\cos(\beta) = \frac{\sqrt{3}}{2}$, where $0° < \alpha, \beta < 90°$, find the value of $\sin(\alpha + \beta)$.

1. 0.58
2. 0.72
3. 1.85
4. 0.96

$\alpha = 45°$ $\quad$ $\beta = 30°$

$\cos\alpha = \frac{1}{\sqrt{2}}$ $\quad$ $\cos\beta = \frac{\sqrt{3}}{2}$

$\sin(\alpha+\beta) = \sin\alpha \cdot \cos\beta + \sin\beta \cdot \cos\alpha$

Question-10

Find value of x for following expression:

(i) $\frac{1}{(0.001)} = 10^{-x}$

(ii) $3^x = 1$

$\frac{1}{10^{-3}} = 10^{-x}$

$10^3 = 10^{-x}$

$-x = 3$

$x = -3$

$3^x = 1$

$3^0 = 1$

Question-10

Find value of x for following expression:

(iii) $\sqrt{0.49} = 700 \times 10^{-x}$

$\sqrt{0.49} = \sqrt{\frac{49}{100}} = \frac{7}{10} = 0.7$

$0.7 = \frac{0.7 \times 1000}{1000} = 700 \times 10^{-3}$

Comp.

$\boxed{x = 3}$

(iv) $\sqrt{1-x} = 3^{3/2}$

$\sqrt{1-x} = (1-x)^{1/2} = 3^{3/2}$

$1-x = 3^{\frac{3}{2} \times 2}$

$1-x = 3^3$

$1-x = 27$

$1-27 = x$

$\boxed{x = -26}$

Question-10

Find value of x for following expression:

(v) $\frac{0.125}{(1/x)} = e^{\circ}$

(vi) $\frac{6}{0.3} = 5 \times (2^x)$

$\frac{0.125}{\left(\frac{1}{x}\right)} = 1$

$0.125 = \frac{1}{x}$

$\frac{\cancel{125}}{\cancel{1000}_{8}} = \frac{1}{x}$

$\boxed{x = 8}$

$\cancel{20}^{4} = \cancel{5} \times 2^{x}$

$2^2 = 2^x$

$x = 2$

Question-10

Find value of x for following expression:

(vii) $\dfrac{\overset{9}{\cancel{153}} \times \overset{27}{\cancel{162}} \times \cancel{13} \times \cancel{3}}{\underset{6}{\cancel{18}} \times \cancel{17} \times \underset{\cancel{9}}{\cancel{117}}} = (9)^{\frac{x}{2}}$

$6 \,|\, 162 \,|\, 27$

12

42

42

0

$27 = 9^{x/2}$

$3^3 = 3^{\cancel{2} \times \frac{x}{\cancel{2}}}$

$x = 3$

A

(viii) $\dfrac{(4^x + 4^{-1}) \times 2^2}{10} = \sqrt{\dfrac{\overset{25}{\cancel{125}}}{\cancel{5}} \times 10^{-2}}$

$\dfrac{\left(4^x + \frac{1}{4}\right) \times 4}{10} = \sqrt{25 \times 10^{-2}}$

$\dfrac{4^x \times 4 + \cancel{4} \times \frac{1}{\cancel{4}}}{\cancel{10}} = 5 \times 10^{-1} = \dfrac{5}{\cancel{10}}$

$4 \times 4^x + 1 = 5$

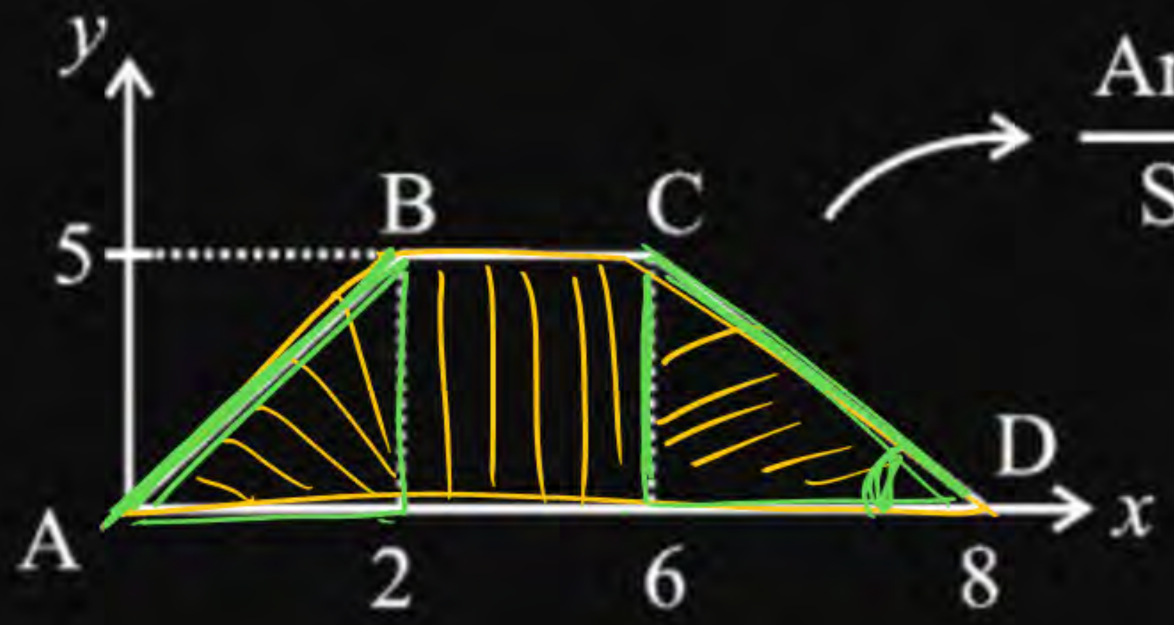
$\cancel{4} \times 4^x = \cancel{4}^1$

$4^x = 1$

Question-10

Find value of x for following expression:

(ix)



$$\frac{\text{Area (ABCD)}}{\text{Slope (AB)}} \times \text{Slope (CD)} = x$$

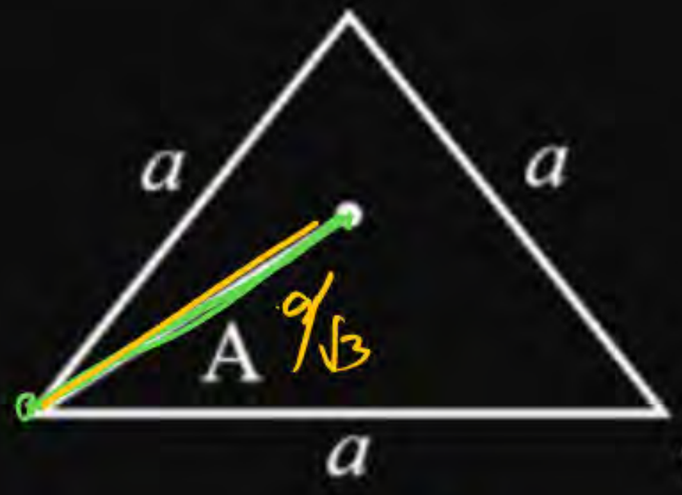
$$\frac{\frac{1}{2} \times (8+4) \times 5}{\cancel{\frac{5}{2}}} \times \cancel{-\frac{5}{2}} = x$$

$x = -30$

Question-10

Find value of x for following expression:

(x)



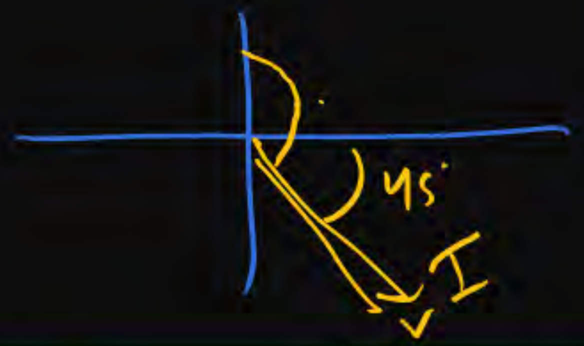
$$\frac{\cancel{a}}{\cancel{a}/\sqrt{3}} = \frac{B}{A} = (x)^{1/2}$$

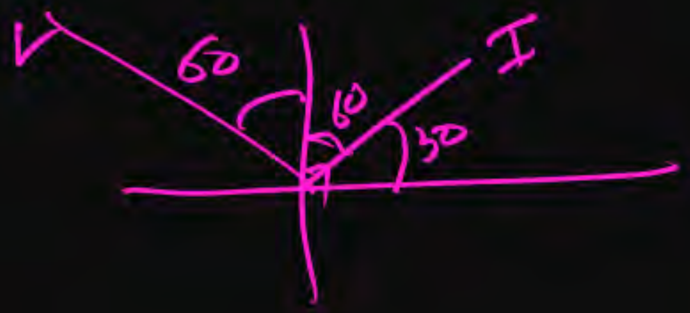
$$\sqrt{3} = \sqrt{x}$$

$$\boxed{x = 3}$$

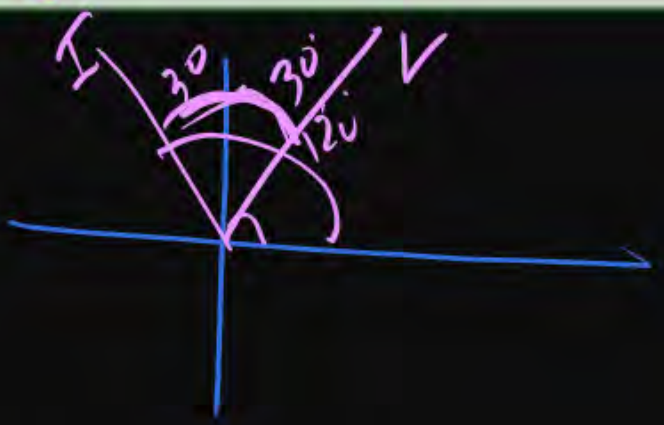
Question-11

Correct matrix match





(A) $I = \sin(\omega t - \pi/4)$ $V = \cos(\omega t - 3\pi/4)$	(i) Current lay voltage by $2\pi/3$
(B) $I = \sin(\omega t + \pi/6)$ $V = \cos(\omega t + \pi/3)$	(ii) Voltage leads by current by $\pi/6$
(C) $I = \sin(\omega t - \pi/6)$ $V = \cos(\omega t + \pi/6)$	(iii) Current leads by voltage $\pi/3$
(D) $I = \sin(\omega t + 2\pi/3)$ $V = \cos(\omega t - \pi/6)$	(iv) Voltage is in phase of current



Question-12

Correct matrix match

(A) $\sin(-120)$ $= -\sin(120) = -\frac{\sqrt{3}}{2}$	(1) $\frac{4}{5}$
(B) $\cos(150) = -\frac{\sqrt{3}}{2}$	(2) $-\frac{\sqrt{3}}{2}$
(C) $\tan(135) = -1$	(3) $-\frac{\sqrt{3}}{2}$
(D) $\tan(143) = \tan(180-37)$ $= -\tan 37 = -\frac{3}{4}$	(4) -1
(E) $\underbrace{\sin(127)}_{\sin(180-53^\circ) = +\frac{4}{5}}$	(5) $-\frac{3}{4}$

Question-13

If 64 identical liquid sphere combine to bigger sphere then find radius of bigger sphere.

Volume Cn.

$R = n^{1/3} r$

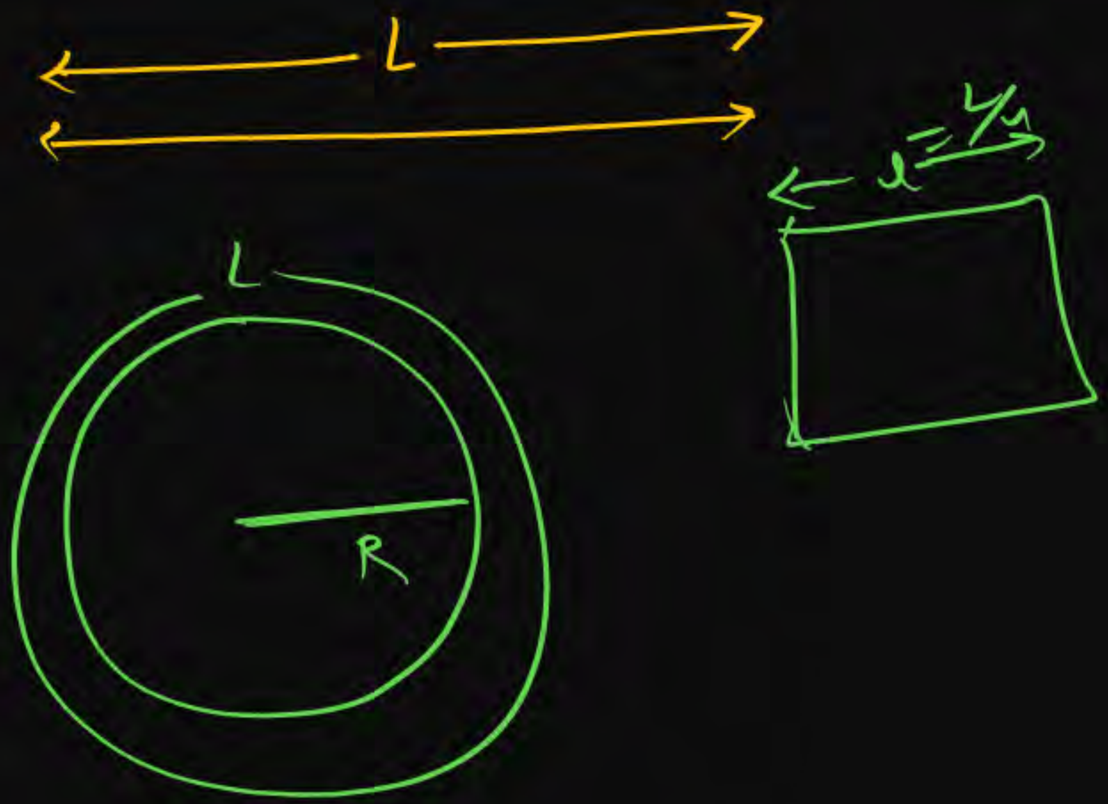
$= (64)^{1/3} \times r$

$R = 4^{\cancel{3} \times \frac{1}{\cancel{3}}} r$

$R = 4r$

Question-14

A wire of length L bend into circle and square then find ratio of radius of circle and side of square.



$$2\pi R = L$$

$$R = \frac{L}{2\pi}$$

$$\frac{R}{l} = \frac{\frac{\cancel{L}}{2\pi}}{\frac{\cancel{L}}{4}} = \frac{4}{2\pi} = \frac{2}{\pi}$$

Question-15

Which of the following is True/False.

(i) $2^3 \times 2^2 = 2^6$ F

$2^{3+2} = 2^5$

(ii) $2^{10} \times 3^{10} = 5^{10}$

F ×

Question-15

Which of the following is True/False.

(iii) $2^{10} \times 3^{10} = 6^{10}$

(iv) $\sqrt{xy} = \sqrt{x} \times \sqrt{y}$

$(2\times2\times2\times2\times2\times2\times2\times2\times2\times2)\times3\times3\times3\times3\times3\times3\times\ldots$

$6\times6\times6\times6\times6\times6\times6\times6$

$= 6^{10}$

Question-15

Which of the following is True/False.

(v) $\sqrt{x+y} = \sqrt{x} + \sqrt{y}$ ✗

(vi) $4^2 + 3^2 = 7^2$

$16+9$ ✗

$\sqrt{xy} = \sqrt{x} \times \sqrt{y}$

Question-15

Which of the following is True/False.

(vii) $\frac{1}{3} < \frac{1}{\sqrt{3}}$ ✓

$\frac{1}{3} < \frac{1}{1.71}$

(viii) $\frac{4}{3} < \frac{3}{4}$

F

Question-15

Which of the following is True/False.

(ix) $\frac{2}{3} < \frac{7}{5}$ T

(x) $2.0 = 0.02 \times 10^{-2}$ F

0.66

$2.0 = \frac{2.0 \times 100}{100}$

$= 0.02 \times 10^{2}$

Question-16

Find x in given expression:

(i) $\frac{1}{2}+\frac{1}{5}+\frac{1}{7}=x$

$\Rightarrow \frac{35+14+10}{70}=x$

$x=\frac{59}{70}$

(ii) $27=3^{\frac{1}{x}}$

$3^3=3^{1/x}$

$\frac{1}{x}=3$

$x=1/3$

Question-16

Find x in given expression:

(iii) $32 = \left(\sqrt{2}\right)^{x}$

$$2^5 = 2^{\frac{1}{2}\times x}$$

$$\frac{x}{2} = 5$$

$$x = 10$$

(iv) $\dfrac{\sqrt{4}}{4^2} = 46x$

$$\frac{\cancel{2}}{\cancel{16}\,8} = 46x$$

$$x = \frac{1}{8\times 46}$$

Question-16

Find x in given expression:

(v) $\dfrac{0.001 \times 10^{-4}}{10 \times 10^{-3}} = 10^{x}$

$$\frac{\cancel{10^{-3}} \times 10^{-4}}{10 \times \cancel{10^{-3}}} = 10^{x}$$

$$10^{-5} = 10^{x}$$

$$x = -5$$

(vi) $y^{2} . y^{3/2} = y^{x}$

$$y^{\left(2+\frac{3}{2}\right)} = y^{x}$$

Question-16

Find x in given expression:

(vii) $\dfrac{4200 \times 0.001}{10^{-2}} = 42 \times 10^{x}$

$$\frac{4200 \times \cancel{10^{-3}}^{\,10^{-1}}}{\cancel{10^{-2}}} = 42 \times 10^{x}$$

$$420 = 42 \times 10^{x}$$

$$\cancel{42} \times 10^{1} = \cancel{42} \times 10^{x}$$

$$\boxed{x = 1}$$

(viii) $\dfrac{0.326 \times 10^{-4}}{10^{+3}} = 32.6 \times 10^{x}$

$$0.326 \times 10^{-4} \times 10^{-3} =$$

$$\frac{100 \times 0.326 \times 10^{-7}}{100} = 32.6 \times 10^{-9}$$

$$\boxed{x = -9}$$

Question-16

Find x in given expression:

(ix) $0.52 \times 10^{-8} = 520 \times 10^{x}$

$\frac{52}{100} \times 10^{-8} = \frac{52 \times 10^{-10} \times 10}{10}$

$= 520 \times 10^{-11}$

(x) $\frac{0.75 \times 30}{45 \times 0.25} = 4^{\frac{1}{x}}$

$\frac{\cancel{\frac{3}{4}} \times \cancel{30}^{2}}{\cancel{45}_{15} \times \cancel{\frac{1}{4}}} = 2 = 4^{1/x}$

$2^{1} = 2^{2/x}$

$\frac{2}{x} = 1$

$\boxed{x = 2}$

Question-17

In a decay process the number of nuclei $N = N_0 e^{-\lambda t}$ where N_0 and λ is constant, find rate of decay

(1) λN_0

(2) $-\lambda N$

(3) $N_0 \lambda e^{-\lambda t}$

(4) $\dfrac{\lambda}{N_0}$

$$\boxed{N = N_0 e^{-\lambda t}} \quad (1)$$

$$\frac{dN}{dt} = N_0 e^{-\lambda t} \times (-\lambda)$$

$$\frac{dN}{dt} = -\lambda N_0 e^{-\lambda t}$$

$$= -\lambda N$$

Question-18

Focal length 'f' of a lens varies with temperature as $f = f_0(1 + \alpha T)$ find $\dfrac{df}{dT}$ = ??

1. αf_0 ✓
2. f_0
3. α
4. f_0/α

$$f = f_0(1 + \alpha T)$$

diff w.r.t T

$$\frac{df}{dT} = f_0\left(0 + \alpha \frac{dT}{dT}\right)$$

$$\frac{df}{dT} = f_0 \alpha$$

Question-19

Electric potential in a conservative field varies with space as $V = ax^2 + by + cz$, find electric field at point (1, 1) if $\boxed{E = -\dfrac{dV}{dr}}$

(1) $2a\hat{i} + b\hat{j}$

(2) $2\hat{i} - b\hat{j}$

(3) $2a\hat{i} - b\hat{j}$

(4) $-(2a\hat{i} + b\hat{j})$ ✓

$V = ax^2 + by + cz$

$\frac{\partial V}{\partial x} = a(2x)\hat{i}$

$\frac{\partial V}{\partial y} = b\hat{j}$

$\frac{\partial V}{\partial z} = c\hat{k}$

$\vec{E} = -[2ax\hat{i} + b\hat{j} + c\hat{k}]$

$\vec{E} = -[2a\hat{i} + b\hat{j} + c\hat{k}]$

Question-20

$\gamma = a \cos t, x = a(t - \sin t)$ find $\frac{dy}{dx}$ at $t = \frac{\pi}{2}$

1. -1
2. 1
3. 0
4. $1/2$

$y = a \cos t$

$x = a(t - \sin t)$

$\frac{dy}{dt} = -a \sin t \quad -(1)$

$\frac{dx}{dt} = a(1 - \cos t)$

$\frac{dy}{dx} = \frac{-\sin t}{1 - \cos t} = \frac{-\sin(\pi/2)}{1 - \cos \pi/2} = -1$

Question-21

$x = a\cos^3 t, \gamma = a\sin^3 t$ find $\dfrac{dy}{dx}$

1. $\cot t$
2. $\tan t$
3. $-\dfrac{1}{\tan t}$
4. $-\dfrac{1}{\cot t}$

$X = a\cos^3 t$

$X = a(\cos t)^3$

$\dfrac{dx}{dt} = a\,3\cos t^2 \times -\sin t$

$\dfrac{dx}{dt} = -3a\cos^2 t \cdot \sin t$

$\dfrac{dy}{dt} = a\,3\sin^2 t \cdot \cos t$

$\dfrac{\frac{dy}{\cancel{dt}}}{\frac{dx}{\cancel{dt}}} = \dfrac{dy}{dx} = \dfrac{\cancel{3a}\,\sin^{\cancel{2}}t \cdot \cancel{\cos t}}{-\cancel{3a}\,\cos^{\cancel{2}}t \cdot \cancel{\sin t}}$

$= -\tan t$

$= -\dfrac{1}{\cot t}$

Question-22

$x^3 + y^3 = 3xy$, find $\frac{dy}{dx}$

(1) $\frac{y - x^2}{y^2 - x}$

(2) $\frac{y^2 - x}{y - x^2}$

(3) $\frac{y^2 - x^2}{y^2 + x^2}$

(4) $\frac{y + x^2}{y^2 + x}$

$3xy = x^3 + y^3$

diff^n w.r.t (x)

$3\left[\frac{dx}{dx}y + x\frac{dy}{dx}\right] = \frac{dx^3}{dx} + \frac{dy^3}{dx} \times \frac{dy}{dy}$

$3\left[y + x\frac{dy}{dx}\right] = 3x^2 + 3y^2 \times \frac{dy}{dx}$

$3\left[y + x\frac{dy}{dx}\right]$

$3y + 3x\frac{dy}{dx} = 3x^2 + 3y^2\frac{dy}{dx}$

$\frac{dy}{dx}(3y^2 - 3x) = 3y - 3x^2$

$\frac{dy}{dx} = \frac{y - x^2}{y^2 - x}$

Question-23

$x = t + 1$ and $y = t^2 + t^3$ find $\dfrac{d^2y}{dx^2}$

(1) $2 + 6t$

(2) $2 - 6t$

(3) $2 + 6t^2$

(4) $2 - 6t^2$

$$\boxed{\frac{dx}{dt} = 1} \quad -(1)$$

$$\frac{dy}{\cancel{dt}} = 2t + 3t^2 \quad -(1)$$

$$\frac{dx}{\cancel{dt}} = 1$$

$$\boxed{\frac{dy}{dx} = 2t + 3t^2}$$

$$\frac{d^2y}{dx^2} = \frac{d(2t+3t^2)}{dx}$$

$$= 2\frac{dt}{dx} + 3\frac{dt^2}{dx}$$

$$= 2 \times 1 + 3\frac{dt^2}{dx} \times \frac{dt}{dt}$$

$$= 2 + 3(2t) \times \frac{dt}{dx}$$

$$\boxed{\frac{d^2y}{dx^2} = 2 + 6t}$$

Question-24

A charged particle moves such that $x(t) = Ae^{kt}$ what is the electric current if charge is proportional to x.

$\boxed{Q \propto x}$

1. kAe^{kt}
2. Ae^{kt}
3. Ake^{-kt}
4. zero

$Q = Cx$

$x = Ae^{kt}$

$Q = CAe^{kt}$

$\frac{dQ}{dt} = CA\,e^{kt}\,k$

$= CkAe^{kt}$

Question-25

Kinetic energy of a particle is given as $k = at^3$, find power delivered to particle if power is rate of change in kinetic energy w.r.t. time:

1. $3at^2$
2. $2at$
3. at^2
4. None

$$K = at^3$$

$$P = \frac{dK}{dt} \quad \text{given}$$

$$P = \frac{d(at^3)}{dt}$$

$$P = a\,3t^2 = 3at^2$$

Question-26

A particle moves such that its velocity and position are related by $v = kx$, if acceleration is defined as $\frac{v\,dv}{dx}$ find its acceleration at $x = 2\text{m}$.

1. $2k$
2. $2k^2$
3. $4k$
4. zero

$\boxed{v = kx \quad —(1)}$

Diff w.r.t. x

$\frac{dv}{dx} = \frac{d(kx)}{dx}$

$\boxed{\frac{dv}{dx} = k \cdot 1}$

$a = v\frac{dv}{dx}$

$a = kx \times k$

$\boxed{a = k^2 x}$

$a = 2k^2$

Ans.

Question-27

Volume of a gas changes with temperature as $V = \frac{A}{T}$, find rate of change in volume w.r.t. temperature. [A = constant]

(1) $\frac{A}{T^2}$

(2) $-\frac{A}{T^2}$

(3) $\frac{A}{T}$

(4) zero

$V = \frac{A}{T} = AT^{-1}$

$\frac{dV}{dT} = A\frac{dT^{-1}}{dt}$

$= -AT^{-1-1}$

$= -AT^{-2} = -\frac{A}{T^2}$

Question-28

Horizontal range in projectile motion can be given as $\frac{u^2 \sin 2\theta}{g}$ as shown below, find angle of projection for which range will be maximum.

(1) 45°

(2) 60°

(3) 37°

(4) 53°

$$R_{max} = \frac{u^2 \sin 2\theta}{g}$$

fixed

$$R_{max} = |\sin 2\theta|_{max}$$

R_m

$$\sin 2\theta = 1$$

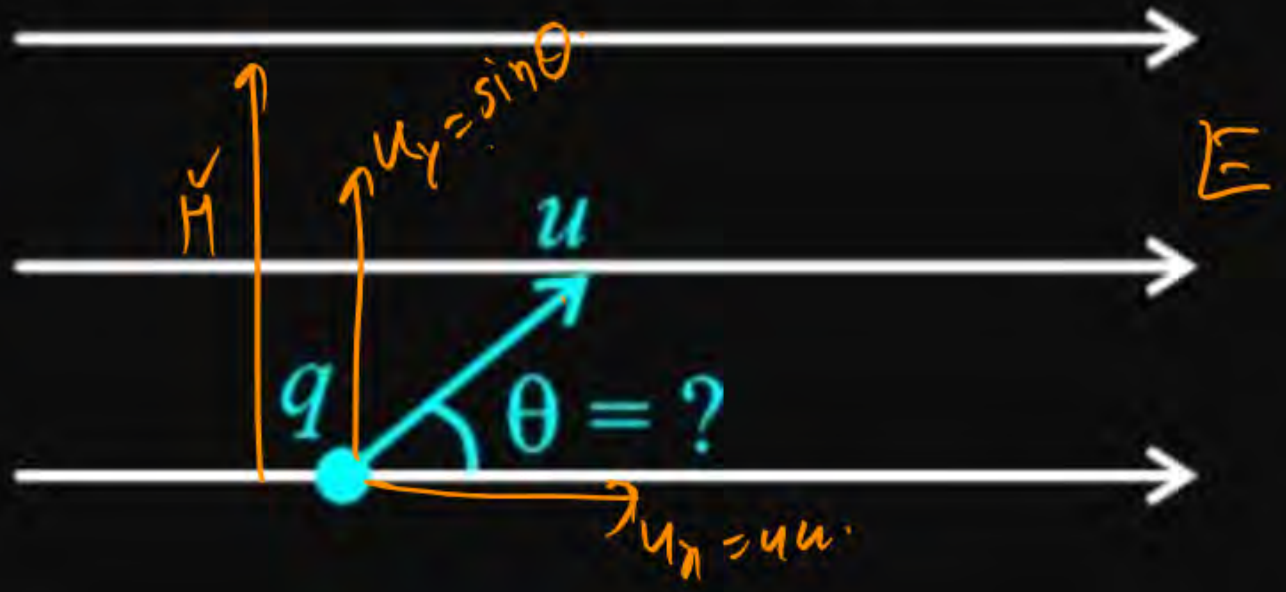
$$2\theta = 90$$

$$\theta = 45$$

Question-29

Project

A charged particle is ~~released in~~ a uniform horizontal electric field. At what initial angle it should be projected so that maximum height attained, if maximum height attained is directly proportional to vertical velocity and force inside electric field is $F = qE$



(1) $\theta = 0°$

(2) $\theta = 90°$

(3) $\theta = 180°$

(4) $\theta = 45°$

$H_{max} \propto u \sin\theta_{max}$

$\theta = 90$

Question-30

In prism experiment deviation can be given as $\boxed{\delta = i + e - A}$ as shown below. Then find the condition if deviation is minimum.

(1) $i = 0°$ ✗

(2) $i = 90°$ ✗

(3) $e = 0°$ ✗

(4) $i = e$ ✓

Mayun

δ will be max or min, if $\frac{d\delta}{di} = 0$

$$\delta = i + e - A$$

$$\frac{d\delta}{di} = \frac{d(i+e-A)}{di}$$

$$0 = \cancel{\frac{di}{di}} + \frac{de}{di} - \cancel{\frac{dA}{di}}^{\,0}$$

$$0 = 1 + \frac{de}{di}$$

$$\frac{de}{di} = -1$$

$$\int de = -\int di$$

$$\boxed{e = -i}$$ ✓

Question-31

The potential energy stored in a spring varies as $U = \frac{1}{2}kx^2 + \alpha x^3$, for what value of x, magnitude of force is maximum if force and potential energy related as $F = -\frac{\partial U}{\partial x}$

$\frac{dF}{dx} = 0$

(1) $x = \frac{k}{6\alpha}$

(2) $x = \frac{6k}{\alpha}$

(3) $x = \frac{-6k}{\alpha}$

(4) $x = \frac{-k}{6\alpha}$

$U = \frac{1}{2}kx^2 + \alpha x^3$

$F = \frac{dU}{dx}$

find force

then $\frac{dF}{dx} = 0$

कैसे $\frac{dF}{dx} = 0$

Question-32

Work done by gas is given by $dW = P.dV$, if $V = ax^2 - bx$, find value of x at which work is maximum.

1. $\frac{a}{2b}$
2. $\frac{b}{2a}$
3. $\frac{a}{b}$
4. $-\frac{a}{b}$

→ Work is maximum when $\left(\frac{dW}{dx}\right) = 0$

$\left(\frac{dW}{dx}\right) = P\left(\frac{dV}{dx}\right)$

$V = ax^2 - bx$

$\frac{dV}{dx} = 2ax - b = 0$

$2ax - b = 0$

$x = \frac{b}{2a}$ ✓

Question-33

Force on charge 'q' on axial point at a distance 'x' from centre of uniformly charged ring is $\frac{kqx}{(R^2+x^2)^{3/2}}$ where, k is constant, R is radius of ring. For what value of x, force will be maximum.

(1) $x = \frac{R}{2\sqrt{2}}$

(2) ✓ $x = \frac{R}{\sqrt{2}}$

(3) $\sqrt{2}R$

(4) R

$$E = \frac{kqx}{(R^2+x^2)^{3/2}} = \frac{kq\, x}{(R^2+x^2)^{3/2}}$$

$$\frac{dE}{dx} = 0$$

E_{max}

$$E = \frac{x}{(R^2+x^2)^{3/2}}$$

$$0 = \frac{dE}{dx} = \frac{(R^2+x^2)^{3/2}\frac{dx}{dx} - x\,\frac{d(R^2+x^2)^{3/2}}{dx}}{(R^2+x^2)^{3/2\times 2}}$$

$$0 = \boxed{(R^2+x^2)^{3/2}\times 1 - x\,\tfrac{3}{2}(R^2+x^2)^{1/2}\times 2x}$$

$$\cancel{(R^2+x^2)^{3/2}} = 3x^2\,\cancel{(x^2+R^2)^{1/2}}$$

$$(R^2+x^2) = 3x^2$$

$$R^2 = 2x^2 \rightarrow x^2 = \frac{R^2}{2}$$

$$x = R/\sqrt{2}$$

THANK YOU